

Technical note

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Equipment for the recording of tractive power in vacuum extractions

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Vacuum extraction (VE) is a widely used method for vaginal termination of labor. It is agreed in principle that this method presents an **additional danger for mother and child** which is proportional to the difficulty of these case. For this reason its use should always be clearly indicated. Despite extensive clinical experience with the VE, only very few objective data exist concerning the amount of tractive power applied. It would be interesting for clinicians to know, for example, the **force** of the tractions and the **number** necessary on average to extract the baby from the inlet, middle or floor of the pelvis. With regard to complications to the infant (e. g. cephal-hematoma, skin wounds, etc.) it would be useful to know how much traction power can be applied before such damage may occur. It is also important to know the **critical point beyond which the suction cap is in danger of being torn off**. A further critical question is that of the use of the **VE in premature infants**. Is the application of the VE really more dangerous to underweight babies than a forceps? Some in fact advocate the use of the VE in prematures [1].

Many questions could be better answered by objective data about the tractive power of the VE.

Description of the equipment

We have developed apparatus (Fig. 1) with which it is relatively simple to measure the **strength and duration of traction** in the clinically applied VE.

The appliance consists of:

1. A **cell for the measurement of traction (A)**, which is built into the appliance between the hand operating the appliance (C) and the **suction cap (I)**.
2. A **recording system (E)**, a **plug-in** for the preparation of measured values (D) and a **connection (F) to a fetal heart-rate monitor**. This parallel connection to the heartrate monitor makes it possible to directly compare the patterns of heart rate frequency and contractions with the record of tractive power simultaneously by laying one diagram on top of the other.

The cell for the measurement of tractions

In order to electronically record the amount of tractive power, it is necessary to have a device to **translate the mechanical force into an analogous electric voltage**. There is a large number of known procedures (e. g. quartz pressure transducer, strain gauge transducer) which fulfil these requirements. We decided upon a system which is particularly robust and reliable. The disadvantage with this appliance is that it cannot be sterilized by heat and therefore has to be

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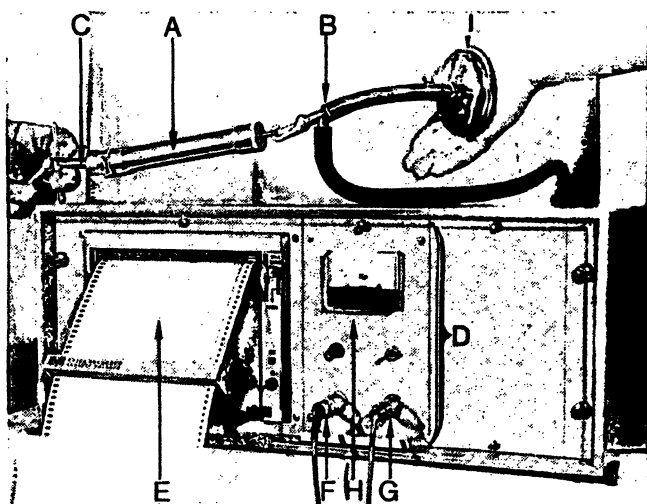


Fig. 1. Equipment for measuring tractive power connected to vacuum suction cap with recording apparatus.

- A Cell for measurement of tractions (CMT)
- B Y-piece for separation of the suction and traction tubes, with safety hook
- C Mobile traction handle with connecting cables to the recorder
- D Plug-in for the preparation of measured values
- E Recording device
- F Connecting cable to cardiocotograph
- G Juncture of cable from the CMT
- H Tractive power meter (connected in parallel to the recorder)
- I Vacuum suction cap

covered with a sterile sleeve when in use. The principle of the cell for measurement of traction (CMT) is based on the **proportionality between the amount of pressure upon a spring and the change in length** which this causes. This displacement is measured by a **displacement transducer** (Philips 9314/05) transmitted over a flexible cable to a **carrier wave oscillator-demodulator** (Philips PR 9309/00) in the plug-in (D) and is there transformed into a D. C. voltage signal which is proportional to the tractive power. The accuracy achieved by this measuring procedure is higher than 1.5% of the maximum power applied.

Recording device and connecting cable to the monitor

A recording device from HEWLETT-PACKARD is used to register the tractive power. This device is of the same type as that used in the car-

diotocograph for the constant monitoring of contraction and fetal heart rate. The tractive power is recorded on the labor channel, the vertical distance between two lines on the sheet corresponds to 5 kp; the full scale is therefore 30 kp. The recorder and the electronics for the CMT are contained in a 19" cabinet (Fig. 1). An **electrical connection with the cardiocotograph** used during the VE had to be produced so that the same recorder could record the heart rate and the tractive power. The necessary signals for the heart rate and the remote pen-lift are transmitted by cable (F) from this cardiocotograph. The first recorded results (Fig. 2) are now being evaluated and will be published shortly.

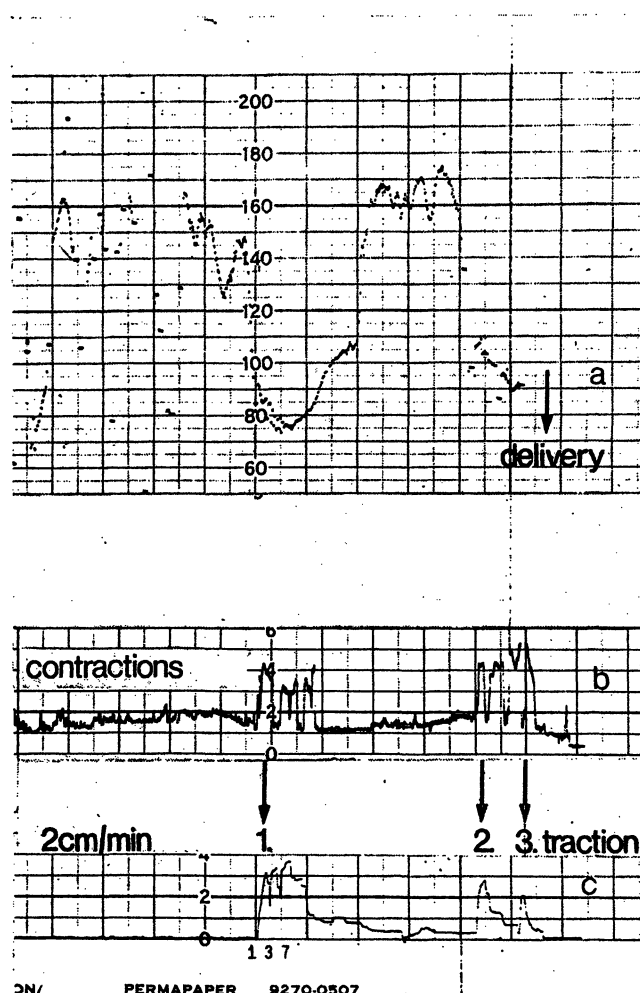


Fig. 2. Example of a record.

- a) fetal heart rate in beats per minute
- b) contractions (external recording)
- c) vacuum extractor tractions every line = 5 kp

Summary

Description of an apparatus for the registration of traction forces on the head of the fetus during a vacuum extraction. With this apparatus it is for the first time possible to register, even during routine vacuum extraction the time and

the force of the traction simultaneously with the cardiogram. The construction of this apparatus is shown in Fig. 1. Fig. 2 shows a registered protocol.

Zusammenfassung

Zugmeßzelle mit Registriereinrichtung für Vakuumextraktionen

Es wird eine Vorrichtung zur Registrierung der bei einer Vakuumextraktion am Kind wirksamen Zugkräfte be-

schrieben. Mit dieser Apparatur ist es erstmalig möglich, im Routineeinsatz Dauer und Stärke der einzelnen Züge parallel zum Kardiotokogramm zu registrieren. Der Aufbau des Gerätes geht aus Abb. 1 hervor; Abb. 2 zeigt ein registriertes Protokoll.

Résumé

Dispositif pour l'enregistrement des puissances de traction pendant l'extraction à l'aide d'une ventouse.

Description d'un appareil d'enregistrement des puissances de traction exercées sur la tête du fœtus pendant l'extraction à l'aide d'une ventouse. Pour la première fois il est possible

d'enregistrer avec ce dispositif, même pendant les ventouses de routine, la durée et la force des tractions simultanément avec le cardiogramme. La construction de cet appareil est montrée sur la fig. 1. La fig. 2 montre un protocole enregistré.

Bibliography

- [1] VUJIĆ, J., V. DÜRRIGL, V. ČUPIĆ, N. ČUTURIĆ: Vakuum-Extraktion bei Frühgeburt. Arch. Gynäk. 207 (1969) 39

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